Generalized Anxiety Disorder During the Pandemic

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Abstract

This study aims to examine what factors impact the onset of generalized anxiety disorder (GAD) by using NATIONAL HEALTH INTERVIEW SURVEY. My research suggests that women who have depression are at the highest risk of developing GAD.

According to the dataset from 2020 and 2021, one of the biggest factors is depression. People are 711% more likely to have GAD if they suffer from severe depression, but they are 80% less likely if they never have depression. There are huge gaps between two groups.

Generalized anxiety disorder: diagnosis and treatment (Elizabeth A Hoge, Ana Ivkovic and Gregory L Fricchione 2012) suggests that physicians correctly recognize and diagnose GAD only 34% of the time. My research proves that GAD and depression are very similar and often go hand-in-hand.

My research also shows that cognitive function is the biggest factor of GAD in the subgroup of 2021. The odds of people who cannot remember and concentrate at all are 885%. One of the symptoms of GAD is having difficulty concentrating.

In regards to the demographics in this dataset, the average age of people who have GAD are 47.91 (2021) and 49.28 (2020). Women are more likely to have GAD than men. The average combined proportion of women who have GAD in 2021 and 2020 is 14.42%. The average for men is 9.67%.

Introduction

In this pandemic, it is easy to imagine that people have anxiety for many reasons. What, then, is anxiety? Sigmund Freud, who was an Austrian neurologist, said the following.

> the organism was actually taking the frustrated excitation into itself. This "frustrated excitation" had real energy within the psychic dynamisms of the organism, and Freud came to call this frustrated excitation "anxiety."

According to Hal Ritter's analysis of Freud's pleasure principle, "the organism always sought pleasure over unpleasure, that is, what was unpleasurable. When some psychic excitation occurred, the organism would respond to it in a pleasure-seeking manner either by acting on it physically or by establishing a positive. In avoiding the unpleasant consequences, the organism was actually taking the frustrated excitation into itself." (HAL RITTER 1997)

It is harder to avoid unpleasant consequences in a pandemic. Almost every one of is anxious to some extent.

However, it becomes a problem when anxiety becomes very hard to control and it affects daily life. This is what is called "Generalized Anxiety Disorder." The National Institute of Mental Health states that "Generalized Anxiety Disorder (GAD) can make daily life feel like a constant state of worry, fear, and dread." (U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES)

According to the NIMH, the symptoms of GAD are as follows.

- Feeling restless, wound up, or on edge
- Being easily fatigued
- Having difficulty concentrating
- Being irritable
- Having headaches, muscle aches, stomachaches, or unexplained pains
- Difficulty controlling feelings of worry
- Having sleep problems, such as difficulty falling or staying asleep

The symptoms include not only mental issues, but physical issues as well.

I analyzed what factors affect having GAD. I made a predictio to recognize people who have GAD by using the NATIONAL HEALTH INTERVIEW SURVEY (NHIS) from 2021. I also used the same dataset in 2020 to compare and understand how this situation changed during the pandemic.

Literature Review

Before I researched GAD, I reviewed some journals and theses on the topic. One of the journals, which is called *Generalized Anxiety Disorder: Diagnosis and Treatment* (Elizabeth A Hoge, Ana Ivkovic, Gregory L Fricchione 2012) said the following.

> The highest prevalence (7.7%) occurred in the 45-59 year age range, and it was more common in women (7%) than in men (4%).

I was curious to see if the subgroup I made had similar results, so I checked that out in the next chapter.

The journal *Generalized Anxiety Disorder: Diagnosis and Treatment* also had this to say:

> GAD has a modest heritability (0.32, compared with 0.43 for panic disorder). The above meta-analysis also found that environmental experiences are significantly associated with GAD, highlighting the importance of environmental stressors as a risk factor.

With this research, I tried to uncover what environmental stressors arise the risk factors of GAD. It could be due to mental issues, physical suffering, or a financial situation.

Data

I used the dataset “NATIONAL HEALTH INTERVIEW SURVEY (NHIS)” in 2020 and 2021, which featured adults over 21 years old from the Centers for Disease Control and Prevention (CDC). I created a subgroup by using various variables, such as household region (Northeast, Midwest, South, West), age, sex, education level, health status, marital status, financial status, mental status, Covid status, and so on.

I picked a variable of ANXFREQ_A. The question is “How often do you feel worried, nervous, or anxious?” and people who answer “daily” as GAD. I used ages from 18 to 84 (AGEP_A <= 84).

Table 1 shows people’s age mean, standard deviation in the subgroup of 2021 and 2020.

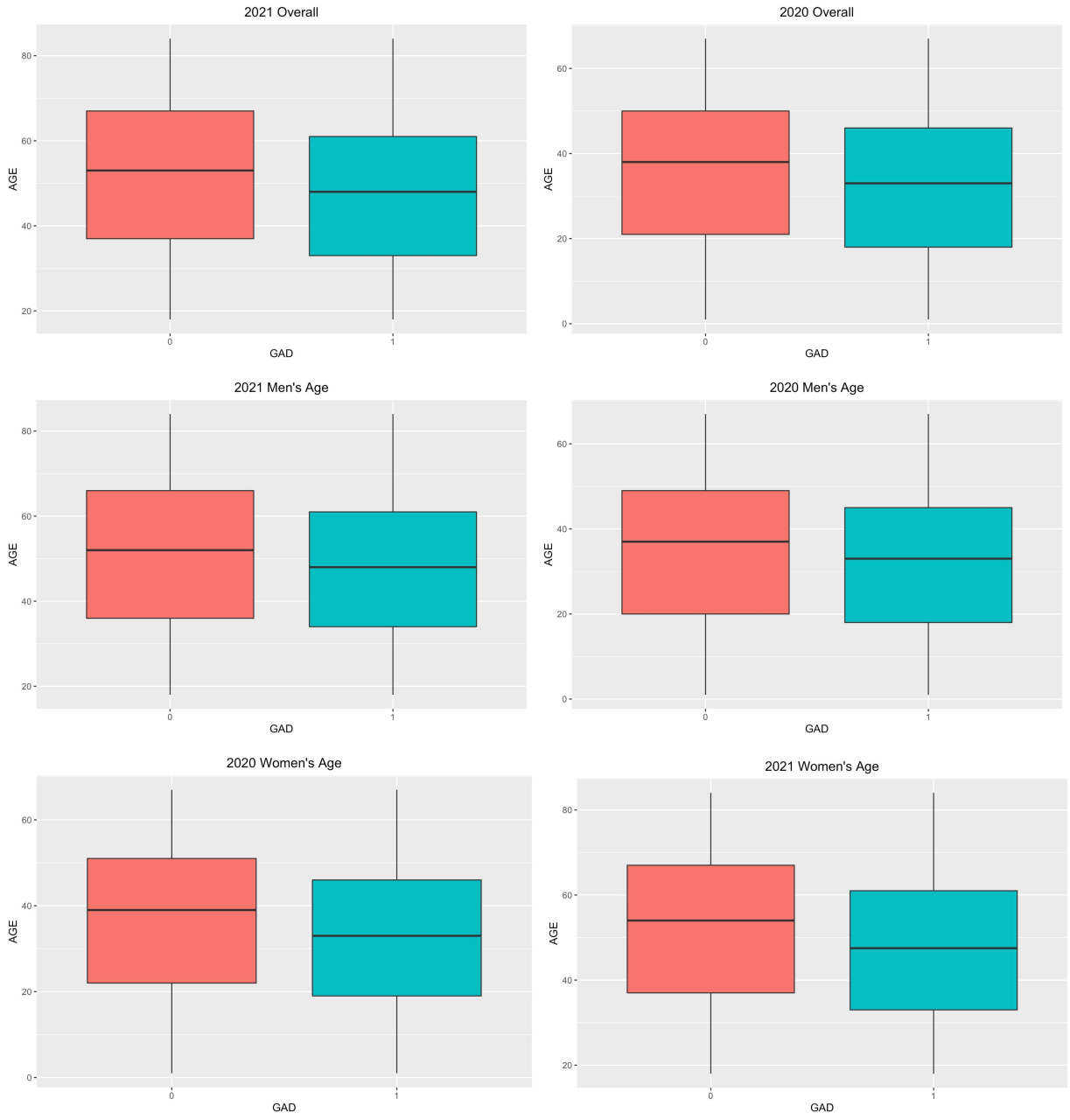
Table-1

	2021 Age Mean	2021 Age Sd	2020 Age Mean	2020 Age Sd
Overall	51.43	17.59	52.40	17.30
GAD Overall	47.91	17.01	49.28	16.69
Not GAD Overall	51.93	17.62	52.83	17.33
Men GAD	48.28	16.76	49.07	16.34
Men Not GAD	51.19	17.53	52.01	17.21
Women GAD	47.70	17.16	49.41	16.90
Women Not GAD	52.59	17.67	53.59	17.42

In 2021, there was a 3.55 years old difference overall between those who had GAD and those who do not have GAD. 2.91 years old difference between men who have GAD and men who does not. 4.59 years old difference between women who have GAD and women who do not.

In 2020, there were 4.02 years old differences between overall who have GAD and overall who do not have GAD. 2.94 years old difference between men who have GAD and men who do not. 4.18 years old difference between women who have GAD and women who do not.

These boxplots show the difference between people who have GAD and people who don't. Top is overall, middle is men, and bottom is women in 2021 and 2020. 1 is GAD and 0 is non-GAD.



I noticed that people who have GAD are younger than non-GAD people in both datasets for 2020 and 2021. In addition, there is a wider age gap between women who are GAD and non-GAD than men in both datasets.

Whether the difference between 95% confidence intervals is significant or not, I used a t-test to check for it in both datasets. The hypothesis is H0: U1=U2, H1: U1 > U2. I compared the overall

ages of those who have GAD and those who do not have GADl, the ages of men who have GAD and who do not have GAD, and the age of women who have GAD and do not have GAD.

As a result, p values are 2.2e-16, 2.981e-08, 2.2e-16 in 2021 and 2.2e-16, 3.582e-09, 2.2e-16 in 2020 respectively, all null hypotheses are rejected and conclude that there is sufficient evidence at a 0.05 level of significance to say that people who have GAD are younger than people who don't.

Table 2 shows proportions of GAD in the dataset. As you can see, women had GAD more than men in both 2020 and 2021. The total number of men was 11,683 in 2021 and 12,878 in 2020; the total number of women was 13,610 in 2021 and 14,514 in 2020. The proportion of men who had GAD was 9.9% in 2021 and 9.44% in 2020. In contrast to men, the proportion of women who had GAD was 14.49% in 2021 and 14.34% in 2020.

Table-2-1
2021

	n	proportion		n	proportion		n	proportion
GAD Overall	3129	12.37%	Men GAD	1157	9.90%	Women GAD	1972	14.49%
Not GAD Overall	22164	87.63%	Men Not GAD	10526	90.10%	Women Not GAD	11638	85.51%

Table-2-2
2020

	n	proportion		n	proportion		n	proportion
GAD Overall	3298	12.04%	Men GAD	1216	9.44%	Women GAD	2082	14.34%
Not GAD Overall	24094	87.96%	Men Not GAD	11662	90.56%	Women Not GAD	12432	85.66%

Subgroup

I picked and created 54 variables to make the subgroup and run logistic regression models. The variables were basically chosen by region, education, sex, financial situation, mental status, physical status, health history, marital status. These variables are based on the GAD symptoms. The sample fraction was 25293/29482 for the dataset in 2021 and 27392/31568 for the dataset in 2020.

Variables	Description	1	0
REGION1	Household region	Northeast	
REGION2	Household region	Midwest	
REGION3	Household region	South	
REGION4	Household region	West	
SEX	Sex	Male	Female
COLLEGE	Educational level	Above Bachelor's degree	Below Associate

			degree
PHSTAT	General health status	Poor	
HYPEV	Ever been told you had hypertension	Yes	No
CHLEV	Ever told you had high cholesterol	Yes	No
ASEV	Ever had asthma	Yes	No
CANEV	Ever been told you had cancer	Yes	No
PREDIB	Ever had prediabetes	Yes	No
HEARAID	Use hearing aid	Yes	No
DIFF_A	Difficulty walking/steps	Above Some difficulty	No
COMDIFF_A1	Difficulty communicating	No difficulty	
COMDIFF_A2	Difficulty communicating	Some difficulty	
COMDIFF_A3	Difficulty communicating	A lot of difficulty	
COMDIFF_A4	Difficulty communicating	Cannot do at all	
COGMEMDFF_A1	Difficulty remembering/concentrating	No difficulty	
COGMEMDFF_A2	Difficulty remembering/concentrating	Some difficulty	
COGMEMDFF_A3	Difficulty remembering/concentrating	A lot of difficulty	
COGMEMDFF_A4	Difficulty remembering/concentrating	Cannot do at all	
NOTCOV	Coverage status as used in Health United States	Not covered	
PAYBLL12M	Problems paying medical bills, past 12m	Yes	No
CVDDIAG	Ever had COVID-19	Yes	No
RX12M	Took prescription medication, past 12m	Yes	No
DEPFREQ_A1	How often depressed	Daily	
DEPFREQ_A2	How often depressed	Weekly	
DEPFREQ_A3	How often depressed	Monthly	
DEPFREQ_A4	How often depressed	A few times a year	
DEPFREQ_A5	How often depressed	Never	
PAIFRQ3M_A1	How often had pain	Never	
PAIFRQ3M_A2	How often had pain	Some days	
PAIFRQ3M_A3	How often had pain	Most days	
PAIFRQ3M_A4	How often had pain	Every day	
ANYINJURY	Any injury in the past 3 months (not including repetitive strains)	Yes	No
SMKEV	Ever smoked 100 cigarettes	Yes	No
SUPPORT_A1	How often social/emotional support	Always	
SUPPORT_A2	How often social/emotional support	Usually	
SUPPORT_A3	How often social/emotional support	Sometimes	
SUPPORT_A4	How often social/emotional support	Rarely	

SUPPORT_A5	How often social/emotional support	Never	
ORIENT_A1	Sexual orientation	Gay/Lesbian	
ORIENT_A2	Sexual orientation	Straight	
ORIENT_A3	Sexual orientation	Bisexual	
ORIENT_A4	Sexual orientation	Something else	
MARITAL_A1	Current marital status	Married	
MARITAL_A2	Current marital status	Living with a partner (an unmarried couple)	
MARITAL_A3	Current marital status	Neither	
AFVET	Ever serve active duty military	Yes	No
WEIGHTLBTC_A	Weight without shoes (pounds), public use	Integer	
HEIGHTTC_A	Total height in inches, public use	Integer	
AGEP_A	Age	Integer	

Method

Simple Logistic regression

I create a model by using a simple logistic regression to analyze odds of independent variables.

Odds = P/1-P. There is a direct relationship between the coefficients and the odds ratios in logistic regression. logit(p) = log(odds) = log(p/q). Logistic regression is using the logistic as the dependent variable, log(p/q) = a + bX. Then getting rid of the log, p/q = ea + bX. As the result, the odds ratio can be computed by raising e to the power of the logistic coefficient, eb.

I created a dependent variable of “GAD” by using ANXFREQ_A. There are 8 types of answers to this question. Code 1/Daily, Code 2/Weekly, Code 3/Monthly, Code 4./A few times a year, Code 5/Never, Code 7/Refused, Code 8/NA, Code 9/Don't Know.

"GAD usually involves a persistent feeling of anxiety or dread, which can interfere with daily life." (U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES) Therefore, the dependent variable of GAD should be a binary variable for dependent variable of logistic regression. I made a dummy variable where the code 1/Daily is 1, Code 2/Weekly, Code 3/Monthly, Code 4./A few times a year, Code 5/Never are 0. I got rid of people who answers Code 7/Refused, Code 8/NA, Code 9/Don't Know from the datasest.

I choose 30 variables for independent variables to make the simple logistic regression model.(Table-3)

Stepwise Logistic Regression

I used the stepwise logistic regression model to find the best fit combination of predictor variables.

There are three strategies of stepwise regression: forward, backward, and both. I picked the "both" method that starts with no predictors, then I add the most contributive variables (like forward selection). After adding each variable, I removed any variables that no longer provided an improvement to the model fit.

By using this method, the AIC (Akaike information criterion) of the models with 2021 subgroup reduced from 12631.83 to 12599.47, and the models with 2020 subgroup fell from 13287.44 to 13254.49.

Result

Simple Logistic regression

There are 12 variables that are significant in the 95% confidence interval in 2021. Odds of Sex (men) is 0.7. The result corresponded with the data of table-2, where the proportion of women who have GAD is 30% higher than men.

HYPEV_A1 represents people who have been told that they have hypertension. Those who have/had hypertension are 14% more likely to have GAD.

PREDIBA1 represents people who had/have prediabetes. There is a 12% less chance to have GAD in the data set of 2021.

PAYBLL12M_A1 represents people who have had problems paying medical bills for the past 12 months. There is an 89% higher chance of it than with people who don't have this problem.

RX12M_A1 represents people who have taken prescription medication for the past 12 months. If you have taken the medication for the past 12 months, your chance of havint GAD is 61% higher than those who don’t.

The question of PAIFRQ3M is “How often are you in pain?” Those who answer PAIFRQ3M_A3 with “Most days” have a 211% higher change of having GAD than those who don’t. The answer of PAIFRQ3M_A4 is “Every day”. PAIFRQ3M_A4 has the biggest odds in the logistic model that is 302%.

Sexuality and marital status affected dependent variables. Bisexual (178%) and something else (212%) had a higher chance of having GAD. Married people were 12% less likely to have GAD.

There are 11 variables that are significant in the 95% confidence interval in 2020 and 8 variables

correspond with the group of 2021.

SEX_A1(0.72) , HYPEV_A1(1.14), PAYBLL12M_A1(1.88), RX12M_A1(1.66), ORIENT_A3(1.84), CANEV_A1ORIENT_A4(1.92), MARITAL_A1(0.87) and AGEP_A(0.97).

COLLEGE (1.11) represents people who have more than a Bachelor's degree, CANEV_A1(1.2) who have been told they have cancer and DIFF_A(1.25) who are difficult to walk/step are significant on 95% confidence interval in only 2020 dataset group.

I checked the accuracy of these models by using a prediction function. I set the threshold at 0.5. The accuracy level for 2021 is 89.66% and 2020 is 88.03%.

Table-3

Variable	Odds 2021	P-Value	Odds 2020	P-Value
SEX_A1	0.7	< 0.001	0.72	< 0.001
COLLEGE	0.99	0.793	1.11	0.022
HYPEV_A1	1.14	0.014	1.12	0.022
CANEV_A1	0.97	0.687	1.2	0.005
PREDIB_A1	0.88	0.049	0.98	0.767
DIFF_A	0.98	0.669	1.25	< 0.001
COMDIFF_A1	0	0.978	4409.95	0.944
COMDIFF_A2	0	0.979	5416.01	0.943
COMDIFF_A3	0	0.979	9595.62	0.939
COMDIFF_A4	0	0.961	1646.18	0.951
COGMEMDFF_A1	0.3	0.329	0.19	0.097
COGMEMDFF_A2	0.73	0.798	0.48	0.464
COGMEMDFF_A3	1.68	0.68	1.02	0.987
COGMEMDFF_A4	5.52	0.235	1.28	0.85
NOTCOV_A1	1.0094	0.91	1.1	0.254
PAYBLL12M_A1	1.89	< 0.001	1.88	< 0.001
CVDDIAG_A1	1.04	0.544	1.21	0.144
RX12M_A1	1.61	< 0.001	1.66	< 0.001
PAIFRQ3M_A1	0.95	0.868	0.52	0.079
PAIFRQ3M_A2	1.43	0.287	0.75	0.435
PAIFRQ3M_A3	2.11	0.028	1.13	0.742
PAIFRQ3M_A4	3.02	0.001	1.68	0.166
ORIENT_A1	1.94	0.007	0.97	0.876
ORIENT_A2	0.83	0.172	0.79	0.051

ORIENT_A3	1.78	< 0.001	1.84	< 0.001
ORIENT_A4	2.12	0.004	1.92	0.011
MARITAL_A1	0.88	0.004	0.87	0.002
MARITAL_A2	0.94	0.444	1.04	0.626
AFVET_A1	1.12	0.161	0.9	0.196
AGEP_A	0.97	0.001	0.97	< 0.001

Stepwise

I tried to make the most accurate logistic regression model by using the stepwise method. Table-4 shows that the odds of depression have a very strong impact on GAD. DEPFREQ_A1 represent people who feel depressed daily. The odds is 7.11 in 2021. The odds of DEPFREQ_A1 is 3.53 in 2020. This is the biggest odds number of this year' subgroup. On the other hand, DEPFREQ_A5 has the least odds, with 0.2 in 2021 and 0.09 in 2020. Depression is one of the main factors of GAD.

Table-4

2021 Variables	2021 Odds	2021 P values	2020 Variables	2020 Odds	2020 P values
REGION11	1.18	0.008	REGION2	0.91	0.107
SEX	0.79	< 0.001	SEX	0.82	< 0.001
PHSTAT_A	1.2	0.129	COLLEGE	1.16	0.003
HYPEV	1.15	0.019	PHSTAT_A	1.59	< 0.001
PREDIB	0.85	0.022	HYPEV	1.09	0.11
COMDIFF_A1	0.47	0.007	CANEV	1.13	0.102
COMDIFF_A2	0.57	0.052	COMDIFF_A3	1.62	0.081
COMDIFF_A4	0	0.925	COGMEMDFF_A1	0.4	< 0.001
COGMEMDFF_A2	1.44	< 0.001	COGMEMDFF_A2	0.61	< 0.001
COGMEMDFF_A3	2.26	< 0.001	PAYBLL12M	1.54	< 0.001
COGMEMDFF_A4	8.85	0.005	CVDDIAG	1.26	0.118
PAYBLL12M	1.45	< 0.001	RX12M	1.36	< 0.001
CVDDIAG	1.16	0.028	DEPFREQ_A1	3.53	< 0.001
RX12M	1.35	< 0.001	DEPFREQ_A3	0.42	< 0.001
DEPFREQ_A1	7.11	< 0.001	DEPFREQ_A4	0.2	< 0.001
DEPFREQ_A2	2.23	< 0.001	DEPFREQ_A5	0.09	< 0.001
DEPFREQ_A4	0.43	< 0.001	PAIFRQ3M_A1	0.85	0.006
DEPFREQ_A5	0.2	< 0.001	PAIFRQ3M_A3	1.34	< 0.001
PAIFRQ3M_A2	1.27	< 0.001	PAIFRQ3M_A4	1.77	< 0.001

PAIFRQ3M_A3	1.49	< 0.001	SMKEV	1.33	< 0.001
PAIFRQ3M_A4	1.87	< 0.001	SUPPORT_A2	1.15	0.028
SMKEV	1.36	< 0.001	SUPPORT_A3	1.4	< 0.001
SUPPORT_A1	0.68	< 0.001	SUPPORT_A4	1.33	0.018
SUPPORT_A2	0.8	< 0.001	ORIENT_A3	1.47	0.008
ORIENT_A1	1.65	< 0.001	ORIENT_A4	2.08	0.003
ORIENT_A3	1.34	0.018	MARITAL_A3	0.87	0.005
ORIENT_A4	1.83	0.012	AFVET	0.82	0.031
MARITAL_A3	0.83	< 0.001	WEIGHTLBTC_A	0.9976	< 0.001
WEIGHTLBTC_A	0.9972	< 0.001	AGEP_A	0.98	< 0.001
AGEP_A	0.98	< 0.001			

Table-5 shows the proportion of GAD on each depression level. 72.26% in 2021 and 75.15% in 2020 of people who have depression daily also suffer GAD. Almost ¾ of people in this level have GAD. On the other hand, only less than 4% of people who have GAD don't have depression at all.

Table-5

2021	DEPFREQ_A1	DEPFREQ_A2	DEPFREQ_A3	DEPFREQ_A4	DEPFREQ_A5
GAD	719	682	476	721	512
Non-GAD	276	834	1512	6678	12807
Proportion	72.26%	44.99%	23.94%	9.74%	3.84%

2020	DEPFREQ_A1	DEPFREQ_A2	DEPFREQ_A3	DEPFREQ_A4	DEPFREQ_A5
GAD	768	709	451	773	571
Non-GAD	254	890	1513	6876	14507
Proportion	75.15%	44.34%	22.96%	10.11%	3.79%

COGMEMDFF_A4 is the biggest odd in the 2021 model. I checked the frequency between GAD and COGMEMDFF_A1, COGMEMDFF_A2, COGMEMDFF_A3 and COGMEMDFF_A4 to calculate the fraction and proportion.(Table-6)

In the 2021 subgroup, 56.25% of people who are COGMEMDFF_A4 have GAD. 51.64% people who are COGMEMDFF_A3. 23.54% of people who are COGMEMDFF_A2. And 8.67% of people who are COGMEMDFF_A1 have GAD. COGMEMDFF_A4 and COGMEMDFF_A3 have a high proportion of GAD.

Table-6

2021	COGMEMDFF_A4	COGMEMDFF_A3	COGMEMDFF_A2	COGMEMDFF_A1
GAD	9	283	1096	1740
Non-GAD	7	265	3559	18331
Proportion	56.25%	51.64%	23.54%	8.66%

By using the stepwise method, the accuracy level of the model in 2021 is 90.46% that is improved by 0.8%, compared to the simple logistics model of 2021 and 2020 is 89.70% improved by 1.67% compared to the one of 2020. I set the threshold at 0.5.

Conclusion

Both subgroups of 2021 and 2020 showed that depression has a big impact on GAD, and many people who have GAD have depression as well. According to the journal *Generalized Anxiety Disorder: Diagnosis and Treatment*, “Physicians correctly recognized and diagnosed GAD only 34% of the time. Part of the problem may be the misdiagnosis of anxiety as depression. Psychiatric comorbidity is common in GAD- 29-62% of patients are estimated to have major depression.” (Elizabeth A Hoge, Ana Ivkovic, Gregory L Fricchione 2012). My research showed GAD and depression are very similar and often go hand-in-hand. It totally makes sense that physicians correctly recognize and diagnose GAD only 34% of the time.

The average age of people who have GAD are 47.91 (2021) and 49.28 (2020). Women are more likely to have GAD than men. According to *Generalized Anxiety Disorder: Diagnosis and Treatment*, “The highest prevalence occurred in the 45-59 year age range, and it was more common in women than in men.“ My research provides the same result.

In addition to depression, my research determined that cognitive function has a huge impact on GAD. In the stepwise model of 2021(Table-4). The odd is 8.85. It is biggest in the group of 2021. “In comparison to healthy normal comparison subjects, anxious subjects were impaired on measures of short-term and delayed memory.” (Rose C.Mantella Ph.D 2007)

Chronic Pain has also very big odds in both simple logistic regression(Table-3) and stepwise models of 2021(Table-4). 3.02 is the biggest odd in the simple regression model of 2021. This result is supported by the Journal of Anxiety Disorders Volume 56 (Gordon Asmundson 2018). This is a quote from the journal:

> The weighted prevalence of GAD among those with chronic migraines, arthritis and back pain was 6.9%, 4.4%, and 6.1% respectively, compared to 2.6% among the entire sample. Severity of pain was increased among those with comorbid chronic pain and GAD compared with chronic pain conditions alone.

Both stepwise models in 2021 and 2020 showed that depression has a huge impact on GAD. The stepwise models of 2021 also suggest that cognitive function influences GAD situations. Additionally, simple logistic model showed chronic Pain is one of the key factor for GAD.

Reference

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U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES Generalized Anxiety Disorder: When Worry Gets Out of Control Revised 2022

Elizabeth A Hoge, Ana Ivkovic, Gregory L Fricchione 2012 Generalized anxiety disorder: diagnosis and treatment

Rose C.Mantella Ph.D 2007 Cognitive Impairment in Late-Life Generalized Anxiety Disorder.

Gordon Asmundson May 2018 Journal of Anxiety Disorders Volume 56

Dataset and R code

https://github.com/Suguru1846/ECOB2000/tree/main/final